Continuity in Science Education from Middle School through College

A continuum of student research internships is essential to developing the talent extant in all young people. Beginning with middle school, we must foster, encourage and mentor future scientists through the necessary years of study, preparation and experience. Recognizing the potential of all youth of all backgrounds, ethnicities, geography, economic status and academic access, students experience a sequence of authentic research opportunities through three programs:

- **Gains in the Education of Mathematics and Science (GEMS)**
- **Science and Engineering Apprentice Program (SEAP)**
- **College Qualified Leaders (CQL)**

GEMS is a program designed and funded by the NIH and the Army that prepares interested middle/high school students for academically advanced programs. GEMS is dedicated to exciting students about science, technology, engineering and mathematics (STEM) through authentic laboratory research. The students are led by near-peer mentors who translate current research and scientific concepts into modules suitable for GEMS students.

GEMS Program Locations:

Walter Reed Army Institute of Research, MD; ARL-CISD, APG and ARL-A, Adelphi, MD*; GARRED, Redstone Arsenal, AL*; George Washington University School of Engineering, DC*; Salish-Kootenai College, MT*; West Frederick Middle School, MD. *WRAIR conducts training for near-peer mentors.

GEMS 1 modules include: Thompson's Coil, the String Thing or Stringray (wave mechanics), ceramics, brain injuries and seizures, mosquito dissection, liquid nitrogen ice cream, olfactory fatigue, Rube Goldberg designs and construction, etc. G**EMS 2 modules** include: Cooties (bacteria), breast cancer, neurotoxicity, maglev vehicles, cell wars, bioethics, engineering, bridge building, and computer-aided design and construction of wooden models. **GEMS 3** students attend for 4 weeks, and follow a more in-depth study program that includes a presentation and paper. **Modules** include: Cooties, cell wars, blood pressure, egg drop, mouthwash efficacy, logic puzzles, animal behavior, cloning and food chemistry.

SEAP students are academically advanced high school students (mostly 11th and 12th graders) selected to intern in an active research laboratory. Students complete a minimum of 8 weeks, a poster and paper, including a literature review.

Goals:

- Encourage students to pursue science and engineering careers.
- Acquaint qualified high school students with the activities of Department of Defense Laboratories through summer science and engineering research experiences.
- Provide students with opportunities in and exposure to scientific and engineering practice and personnel not available in their school environment.
- Prepare these students to serve as positive role models for their peers by encouraging other high school students to take more science and math courses.

SEAP Locations:

ANSER, Arlington, VA; ARL-A, Adelphi, MD; ARL-CISD, APG, MD; ARL-SEDD, Adelphi, MD; ARL-SLAD, APG, MD; ARL-WMRD, APG, MD; CERDEC, Ft. Monmouth, NJ; GARRED, Redstone Arsenal, AL; MRICD, APG, MD; NATICK, Natick, MA; NHRC/EHEL, Wright Patterson

AFB, OH; NASA, Fairmont, WV; RDECOM, APG, APG, MD; RDECOM-IL, IL ; WRAIR, Silver Spring, MD

CQL is a program for college students who may or may not have previously participated as high students in the SEAP program. Accomplished undergraduate and graduate interns may complete daily research tasks, perform data analysis and contribute to research and publications.

Near-peer mentors are CQLs who divide their time between the teaching laboratory and the research laboratory. As a near-peer mentor, they prepare and teach modules, often related to their specific laboratory skills and knowledge, to the GEMS students.

Goals:

- Afford SEAP mentors the opportunity to have fully trained students return to their laboratory during their college years.
- Mentors have the opportunity to share their passion for science with talented undergraduates.
- Give SEAP students the opportunity to continue their research and training.
- Undergraduates and graduates learn the research process by doing actual studies.
- Provide a learning community for the developing professional
- Prepare a new generation of scientists to be mentors.

GEMS Near-peer mentors 2006 (CQL)